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THIRTY-NINTH ANNUAL REPORT

OF THE

Agricultural Experiment Station

OF THE

UNIVERSITY OF KENTUCKY
LEXINGTON

PART II
Bulletins 264 to 276

1926

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IMPERIAL BUREAU
12 JAN. 1928
OF MYCOLOGY

THIRTY-NINTH ANNUAL REPORT

OF THE

Agricultural Experiment Station

OF THE

University of Kentucky

Lexington, Ky.

FOR THE YEAR 1926

Report of the Director

Meteorological Summaries

Part I.

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**Assigned by the U. S. Department of Agriculture.

LETTER OF TRANSMITTAL

To His Excellency, Hon. William J. Fields, Governor of Kentucky:

Sir:—In accordance with an act of Congress, approved March 2, 1887, entitled, "An Act to establish Agricultural Experiment Stations in connection with the Agricultural Colleges established in the several states under the provisions of an act approved July 2, 1862, and under the acts supplementary thereto," and of the act of the Legislature of the State of Kentucky, approved February 20, 1888, entitled, "An act to accept the provisions of an act passed by the Congress of the United States, approved March 2, 1887, for the establishment and maintenance of Agricultural Experiment Stations in connection with Agricultural Colleges established by the several states and territories under an act of Congress approved July 2, 1862," I herewith submit the Thirty-ninth Annual Report of the Kentucky Agricultural Experiment Station.

Very respectfully,

THOMAS COOPER, *Director.*

January 1, 1927.

UNIVERSITY OF KENTUCKY

Lexington, Ky.

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ANNUAL REPORT

of the

DIRECTOR OF THE

KENTUCKY AGRICULTURAL EXPERIMENT STATION

For the Year 1926

The economic progress of agriculture in Kentucky shows indications of improvement altho in many areas the farm income has been insufficient. The dark tobacco producing region, especially, has been in a most difficult situation. Fortunately, in limited areas, other crops are produced, thus lessening the dependence upon tobacco as a cash crop. Interest in the production of more legumes, strawberries, bush fruits, apples, peaches, sweetpotatoes, garden crops, dairy products and sheep, indicates the significant farm movements and changes that are taking place.

These new interests bring to the Experiment Station problems that are significant to the farmer and which involve his future success. As an illustration, the experience of orchardists in the Henderson area with the codling moth may be cited. It was thought that entomologists had discovered, years ago, effective means for the control and prevention of the codling moth. However, in spite of rigid adherence to the recommended sprays and spraying schedules, the codling moth injury is an increasing problem to the growers in this area. The insect has apparently developed new habits which render the customary methods of control relatively ineffective. A similar situation has appeared in other regions in the general latitude, with the result that the experiment stations in these respective states and the United States Department of Agriculture have found it necessary to reopen investigations in this subject.

Noteworthy progress has been made in studies of the pathology of sterility in mares, mosaic and frenching of plants, the effect of the rarer elements on plant growth and soil improvement. The findings of the Experiment Station continue to be increasingly used by the farmers of the state, as is evidenced by correspondence, personal calls and requests for bulletins.

Economic studies of agriculture have been greatly enlarged during the past two years. Much material is being accumulated and published which should be of aid to the farmer in meeting the larger economic problems confronting him. Interest in these particular studies is marked and showing a steady increase. However, the adoption of methods and practices indicated by the results of these studies is not rapid, but is in about the same proportion as the adoption of improved methods applying to production.

The Experiment Station continues to give much attention to the study of soil problems in the state. An examination of the various economic studies or of the condition of agriculture in the state serves to convince the student of the outstanding need of a sound soil policy on the part of landowners. Irrespective of probable prices, markets and labor supply, the need of a productive soil is imperative. Kentucky must have larger areas on which the soil is properly maintained before it may have the agricultural incomes which natural conditions justify. Hence, the Experiment Station will continue to emphasize this field of research and the application of its results, that there may be a sound foundation upon which to construct a progressive and prosperous agriculture.

The addition of one hundred and three acres to the lands of the Experiment Station, authorized by the last legislature, has been most helpful, not only in consolidating its holdings, but in providing opportunity for the necessary growth of its work. The agricultural land available at the substations, at seven soil experiment fields and at the Experiment Station, is typical of the principal soil areas of the state, and enables a direct application of experimental evidence to each agricultural

region. The forestry tract of fourteen thousand acres provides the basis for forest management studies which should eventually prove of great importance to large landowners in the more rugged sections of the state. This tract has been surveyed and an estimate made of the present timber supply. In general, it is well stocked with young timber, with certain plantings contemplated for land not naturally seeded, and it is in good condition to become a productive property, provided fires can be controlled and prevented.

Frenching of Tobacco. Frenched tobacco plants have been produced experimentally in the greenhouse at will. Tobacco plants appear to french when terminal growth proceeds more rapidly than the necessary nitrogen intake from the soil. Turkish tobacco plants have been used almost exclusively in these studies. Frenched plants rapidly recover normal color when readily available sources of nitrogen are added to the soil. In pot cultures, the disease has been produced in virgin soil high in organic matter, old cultivated soil low in organic matter and in sand cultures. There appears to be a very direct application of the results obtained to obscure diseases of other crops, as pecan and apple rosette and the accompanying die-back conditions.

Tobacco Mosaic. Certain brands of cigarettes, granulated smoking tobaccos and plug chewing tobaccos have been found to carry the mosaic virus in an active state. This may explain the sporadic appearance of tomato mosaic in commercial and experimental greenhouses where infection is often very difficult to explain. Old samples of ground or leaf tobacco, ranging in age from five to thirty-one years, have given positive results when a water decoction has been rubbed on healthy tobacco plants. At the Western Kentucky Substation, tobacco set by men using infected chewing tobacco developed a high percent of mosaic, while check rows set after washing the hands developed a low percentage. The mosaic in the check rows may have resulted from spread from the other rows, as two other large plantings, set while the men were not using tobacco and after washing their hands, were free from

infection. The records were obtained late in the season. Two distinct types of mottled mosaic are common in the tobacco fields of Kentucky. These remained very distinct thru fifteen generations of plants in the greenhouse and when inoculated into plants being set in the field, resulted in marked differences in rates of growth and type of injury. A third type much like one of the former, but differing in that necrotic spots are commonly developed in inoculated plants in the greenhouse, was also studied. A virus disease of tobacco characterized by chlorotic spots in the growing point, rather than by mottling, and by extensive necrotic patterns on the older leaves has been studied in the greenhouse and field and appears distinct from tobacco mosaic as it is ordinarily recognized. The same groups of virus diseases found in tobacco have been obtained from tomatoes. Ring-spot of tobacco in which no symptoms of mosaic are seen, has been found to be nearly as readily transmitted as tobacco mosaic, altho infected plants may grow for long periods showing no symptoms of the disease. A row of burley tobacco plants in a field inoculated with a mosaic tomato plant developed a disease which caused the death of all the leaves present on the plant at the time of inoculation. The midveins first became necrotic and long necrotic streaks developed on the stalk. The subsequent growth showed mosaic and was very much stunted. One case of what appeared to be this disease was observed in a field of tobacco, completely destroying a large portion of it.

Method of Application of Fertilizers for Tobacco. For the past four years, at the Greenville, Mayfield and Campbellsville soil experiment fields, certain plots have been divided and the fertilizers applied broadcast to one-half, and a part of the application put in the hill on the other half. The total application per acre, which was the same in both methods, ranged from 600 to 850 pounds. Nitrate of soda was used at the rate of 200 pounds per acre in both methods on all the fields. In the hill fertilizations, 100 pounds of nitrate of soda was mixed with 100 pounds of acid phosphate and 50 pounds of potash salts, and used in the hill, the remainder of the fertilizers being used

broadcast. It may be that the hill application was too heavy for a test of this kind. No better early growth was observed where the fertilizers were placed in the hill and as an average of all experiments there is a difference of 51 lbs. per acre for broadcast application.

On the Experiment Station farm at Lexington a series of fertilizer tests is being made on tobacco grown in a 6-year rotation consisting of tobacco two years, wheat one year, clover and bluegrass three years, all crops being removed from the land. The average yield of tobacco for six years on land receiving no treatment in addition to the rotation has been 1,348 lbs. per acre. In one test ten tons of manure is applied to the first of the two tobacco crops, the second crop receiving the residual effect of the application. This treatment has increased the average yield 82 lbs. per acre. Two-hundred pounds of nitrate of soda per acre on each tobacco crop has increased the average yield 217 lbs. per acre.

In a 4-year rotation of tobacco, wheat, clover and orchard grass, with 20 tons of manure applied each year for the tobacco, the average annual increase of tobacco for ten years has been 219 pounds per acre. Where 200 pounds of nitrate of soda have been used in the same kind of rotation, with the manure left off, the average annual increase has been 201 pounds per acre. The average annual yield in a similar rotation without either manure or nitrate of soda was 1,324 pounds per acre. Such results, without manure or fertilizers, could not be expected except with a good rotation, and on soils naturally well supplied with mineral elements, such as the soils of central Kentucky.

Quality of Leaf Tobacco as Related to Chemical Characters. A large number of potassium determinations upon samples of different grades of tobacco showed that the better grades of a given class or type contain a higher percentage of potassium than the poorer grades. The determination of chlorine in a considerable number of the samples used for the comparison of potassium content showed that the good leaf of

a given grade usually contains about as much chlorine as the common of the same grade, and sometimes more.

Tobacco Marketing. Considerable attention has been given to bringing together information on earlier organization movements among tobacco growers of Kentucky and adjoining states. Frequently, experiences of earlier organizations are duplicated in later developments and, therefore, knowledge of earlier associations is helpful to the present and future movements. A consideration of legislative enactments designed to foster the development of some of these organizations shows that recent legislation often has a counterpart in earlier acts. Trends in the tobacco industry as shown by price movements, exports, output of manufactured products and the production of different types, are studied to suggest what the future probably has in store. Information obtained from this study has been disseminated for the guidance of farmers in planning their production programs.

Membership Problems. The operation of large centralized associations revealed the fact that membership relations and attitudes were at the base of some of their most outstanding difficulties. A study was undertaken, in cooperation with the Bureau of Agricultural Economics, United States Department of Agriculture, to find out what the problems were and the methods of attacking them. Information was sought as to the ideas of members on a large number of different questions, some of them relating to general principles and others directly to their own organizations. That the principal motive for joining a marketing association is to get better prices was illustrated by the replies received. The study showed that delays in making settlements constitute one of the big problems of the cooperatives. A number of questions dealing with the management and some of the details of various operations brought answers suggesting, in part at least, a lack of specific information regarding their association on the part of many members. The facts obtained point to the importance of carrying on educational work which will develop a better understanding of underlying principles of marketing and organization, of the

services performed by the organization and of the problems involved. Some of the results obtained from this study were published in United States Department of Agriculture Circular 407, entitled, Membership Relations of Cooperative Organizations.

Livestock Marketing. In connection with this study, consideration has been given to the trends of the livestock industry in Kentucky in the past. The trend of hog production in the state has been downward since 1860. The beef cattle industry has made steady growth since 1850. Dairy cows have shown the most noticeable growth. The sheep industry has shown an expansion since 1900, altho there was no great change in the industry between 1850 to 1890.

Data on the seasonal movement of Kentucky livestock to market, obtained for the two leading markets, Cincinnati and Louisville, for the five-year period 1921 to 1926, show that about 58 per cent of the Kentucky cattle received at these two centers are marketed during August, September, October and November. The peak of the movement of calves comes in July. There are two peaks in hog receipts, one in May and the other in October. Sheep and lambs show a highly seasonal movement, 88 percent being shipped during the months of May to August, inclusive.

Information obtained on losses in transit indicates that these are not large when expressed as percentages of the total receipts, but that the total is sufficiently large to warrrant giving careful attention to methods of reducing waste from this source. The chief causes for losses in transit are listed by inspectors as improper loading, overcrowding and lack of proper bedding.

Poultry and Egg Marketing. The gathering of material under this project was completed and the results are being compiled. Attention has been devoted chiefly, during the present year, to market outlets, seasonal movements and prices. The peak of receipts of Kentucky eggs on the New York market is reached in March and April, a little earlier than the peak for that market from all sources, as the latter occurs in April

or May. In the case of Kentucky poultry, there is a decided movement in April and May. The market usually averages strong at this period. Analysis of statistics of Kentucky's poultry industry indicates that receipts from poultry form a larger proportion of gross farm receipts in areas of comparatively low farm income than in areas having larger incomes; also that small farms tend to have larger flocks in proportion to their size than do large farms. Eighty-nine percent of the farms in Kentucky reported chickens in 1920. The average number of chickens per farm and the average value of product per farm in Kentucky are lower than the average of the country. Kentucky showed a smaller number of eggs, but a larger number of chickens raised in 1919 per chicken on farms, January 1, 1920, than the averages for the United States.

Farm Income Studies. Figures on incomes for several years have been brought together and are presented in Table 1, which shows the net earnings of successful farmers in various sections of Kentucky contrasted with those of average farmers in the same localities. The fact has been brought out in investigations in costs and returns from various farm products that control of the cost of production is one of the major causes of variations in net earnings of farmers.

Table 1. Net Earnings of Successful Farmers in Various Sections of Kentucky Contrasted with Average those of Farmers in the Same Localities.

No. Farms	Location (Counties)	Year	Yearly Earnings Average Farmers	Yearly Earnings Most Successful Farmers
162	Shelby, Spencer, Oldham, Hardin	1915	$799	$2,919
80	Kenton	1916	871	1,866
241	Mason, Fleming	1922	1,029	3,203
270	Union, Henderson	1924	465	3,058
115	Jackson, Purchase Region	1922	-113*	638
84	La Rue	1923	332	1,371

*Loss

A Study of Tenant Farms. An analysis has been made of data secured in a study of about 200 typical tenant farmers in Fayette and adjoining counties. There is now in preparation a report showing the net earnings, accumulations and net worth of these tenants, the acreage and combination of crops and the number and kinds of livestock, on profitable and unprofitable tenant farms, and the most important factors underlying financial success. This study brought out some important and interesting facts concerning the family and community relationships of tenants.

The average age of tenants was 42 years; the average years of tenancy 13.4; the average period the tenants had been on the farm occupied at the time of the study 3.4 years. The estimated value of the house occupied by these tenants was $1,107. The average number of persons occupying the houses was 5.4. Fifty-four percent of the houses were in good repair, twenty-five percent fair, and eighteen percent poor.

The average expenditure per family for groceries was $313, and for clothing $176. One hundred and twenty-nine of the tenants, or about 70 percent, stated that they were church members. One hundred and fifty-two reported contributions to churches and charitable institutions, the average contribution being $23.72 per tenant. Most of the tenants showed a lively interest in schools, churches, lodges and other community organizations. About 80 percent were members of the Tobacco Cooperative Marketing Association. Eighty-three percent were subscribers to a daily newspaper. Eighty-one percent had oral leasing contracts with their landlords, and only 19 percent had written contracts.

Costs and Returns for Wheat in Western Kentucky. Twenty-seven wheat crops in Christian County were included in this study during a four-year period. These comprised 1,371 acres and 13,839 bushels. The total cost of producing an acre of wheat was $9.63 with land rent excluded; the average yield was 10.9 bushels per acre, the farm price of which was $11.09, leaving $2.61 per acre for the use of the land. The facts brought out in this study seem to warrant the conclusion that

used in a proper farming system, wheat is a profitable supplementary crop on many farms in Kentucky having suitable soils and other favorable conditions.

Costs and Returns from the Corn Crop in Western Kentucky. In the production of an acre of corn in the Purchase area in 1924, it was found that the number of hours of man labor varied from 18 to 49, the average being 33 hours. Horse work expenditures ranged from 33 to 75 hours per acre, the average being 50 hours. These data were obtained from the records of 19 farms in the counties of Graves, Calloway and Marshall. In 1925, the man hours per acre ranged from 25 to 35, averaging 29 hours per acre. Horse work expenditures averaged 43 hours per acre, ranging from 36 to 68 hours.

Results of investigations in the cost of producing corn in Christian County show that there are wide variations in the amounts of man labor and horse work used in producing an acre of corn in that county. Frequently, there is as much as 50 percent difference in the amount of labor that is required to grow an acre of corn. Thus, the importance of the organization of labor, so that it may be used to the best advantage, and the utilization of types of machinery which will make possible greater labor returns, is apparent. This is illustrated in the production costs taken from the records of two farms in Christian County for 1923; on one, the cost of producing corn was 48 cents per bushel, and on the other $1.28 per bushel. The yields per acre were 46.6 bushels and 25.9 bushels, respectively. Practically 50 percent more of both man and horse labor was required on the farm producing the low yield than on that producing the higher yield.

Corn Root-Rot. The type of root-rot of corn previously reported in the annual report as having been produced by the addition of rotted corn roots collected during the winter from old corn soils has since been produced by the addition of a pure culture of a large spored pythium to sand cultures. The organism was re-isolated from the lesions on the roots and from roots of plants inoculated with rotted corn roots from the field.

Effect of Return of Crop Residues on Yield of Crops. On the Lexington soil experiment field, in a rotation of corn, soybeans, wheat and clover, no increase of crops was obtained by the return of cornstalks, soybean and wheat straw to certain fertilized and unfertilized plots, the differences between residue and no residue plots being easily within the limits of experimental error. In the latter half of the period the residues seemed to depress the yield of corn.

During the last six years of the foregoing experiment, manure has been used in various ways in a rotation of corn, wheat and clover. Six tons of manure per acre increased the yield of corn an average of 5.6 bushels per acre; of wheat following corn, 4.8 bushels. The increase of clover following the wheat was small, being only 128 pounds per acre. On unmanured ground, the yields were: corn, 52.5 bushels; wheat, 24 bushels, and clover, 3,468 pounds. The yields of the untreated plots in the four-year rotation were practically the same as these.

Japan Clover in Legume Mixtures. In the spring of 1925, Japan clover was introduced into the clover and grass mixtures used on the experiment fields, using 5 pounds in a 15-pound mixture per acre. In case of failure of other clovers, it was thought that the Japan clover might reseed itself and produce a crop of hay at least on the better plots and also provide a legume for the check plots and unlimed plots where red and alsike clover make little or no growth. Altho the period of the trials has been short, some very promising results have been obtained. On account of drouth, the general mixture was a failure on most of the fields, with some Japan clover persisting but not making enough seed for a satisfactory stand the next year. On the Campbellsville field, where the general mixture was a failure, enough Japan clover persisted to form a good seed crop in the fall of 1925. A good stand appeared in 1926, giving the following hay yields which are averages of all comparable treatments: no treatment, 1,770 pounds; acid phosphate, 2,304 pounds; limestone and acid phosphate 3,600 pounds; rock phosphate, 3,724 pounds. The effect of rock

phosphate is very significant. It is believed that Japan clover may have a large place in mixtures on many types of soil.

Clover. A continuation of the studies regarding the effects of height and time of clipping sweet clover on growth and mortality has shown that for maximum growth during the second year, the first year's crop, if made into hay, should be cut not earlier than late summer or early fall. Midsummer cutting the first year appears to reduce the second year's growth by one-third. However, in a year of normal weather, it does not appear that the plants are actually killed by any cutting the first year except indirectly thru the heaving of weak root systems during the winter. During summers of abnormal rainfall, it appears that some deaths may occur among plants that have been cut during midsummer.

Fixing Free Nitrogen Experiment. The striking effect of associated sweet clover growth in promoting growth of bluegrass, shown on the plots in this experiment last year, has continued in the bluegrass growth of this year. Sweet clover growth was prevented on the plots this year, so the effect is a residual one from last year. The four plots supporting a sod growth were clipped May 28 and the following weights of grass removed:

Average of air-dry weights from plots 2 and 5 which have grown bluegrass only	2330 grams
Average of air-dry weights from plots 3 and 6 which grew bluegrass and sweet clover last year and bluegrass only this year	6410 grams

(The plots consisted of one square rod each)

Sulfofication in Soils. Laboratory experiments have been started to test the sulfofying power of some thirty or more new samples of soil from different parts of the state, representing all the principal geological divisions. Of seven soil samples tried last year, the addition of calcium carbonate increased the oxidation of added sulfur in all except one and seemed to retard or prevent sulfofication of sulfur compounds originally present, in four. The suggestion is that in some soils a sulfofying organism predominates which thrives under alkaline

conditions but not under acid conditions, whereas in other soils, the reverse is the case.

The Occurrence and Distribution of Manganese. Results obtained with manganese as a cure for chlorosis under field conditions check and confirm the results obtained under experimental conditions and afford evidence that manganese is vitally concerned in the synthesis of chlorophyll which is a fundamental factor in the growth of plants and in the production of foods. The results further show that certain plants apparently require more of this element for their normal growth than others and accordingly thrive best on soils containing relatively large amounts of this element. Results obtained with corn plants grown in sand cultures show that a small amount of copper apparently has an additional beneficial effect on the growth of plants in connection with manganese. Results were also obtained with buckwheat which showed that perfect seeds developed only in cultures containing a combination of manganese, copper, zinc and boron, indicating that zinc and boron may have some function in the fructification of plants.

Experiments showed that rats fed a synthetic diet containing small amounts of organic compounds of the elements manganese, copper, zinc and nickel, have a longer survival period and attain a larger weight than do rats confined to a diet from which these metals are excluded as nearly as possible.

Analytical results show that Kentucky bluegrass, *Poa pratensis*, is relatively rich in manganese, copper and zinc, and contains traces of nickel and cobalt. When fresh green blades of bluegrass are air-dried in the shade, finely ground, and fed to rats in connection with a synthetic diet without the metals mentioned, the rats make a fairly normal growth, which indicates that this important forage crop contains the growth promoting properties in a fairly ample amount. A considerable amount of the green blades of bluegrass was extracted with hot alcohol, which removed practically all the chlorophyll. Rats confined to a synthetic diet plus the chlorophyll-free bluegrass blades did not thrive as well as others receiving the unaltered

blades of bluegrass with the synthetic diet, thus showing that the alcoholic extract contained some of the growth-promoting factors. Analysis of the alcoholic extract of bluegrass blades showed the presence in it of small amounts of copper, manganese and zinc compounds in connection with iron, phosphorus, magnesium, potassium and sulfur. No calcium was found in the alcoholic extract.

Chlorosis of Pin-Oaks. A chlorosis of pin-oaks, occurring both in the nursery and in plantings in Lexington and vicinity, has been studied. The chlorotic plants develop in areas where large amounts of calcium carbonate occur in the soil. It may be brought about from washings from limestone roads or with rubbish in filled ground. In the slightly acid soils in the bluegrass section of the state, these oaks appear to grow normally. The natural distribution of the trees suggests that the habitat is a slightly acid soil. Chemical analyses of chlorotic and healthy leaves show the manganese content to be low in the chlorotic leaves, the other mineral constituents appearing to be about the same in both. In soils where pin-oaks fail, bur-oaks appear to grow normally.

Effect of Pruning upon Fruit Production. The marked difference reported in previous years in the production of lightly pruned trees in the permanent rows as compared with heavily pruned trees of the same varieties of corresponding age in the filler rows was again apparent in 1926. The ratio of production for four years, 1923 to 1926 inclusive, for 66 permanent apple trees with continued light pruning was 295⅛ bushels; for 66 filler apple trees with moderately heavy pruning, 153½ bushels.

Peaches. In a study of the relative merits of planting peach trees of different sizes, the following observations are thus far outstanding: (1) Medium size No. 1 trees make better trees in the orchard than oversize trees, and cost less; (2) small 2 to 3 feet trees, if healthy, are practically equal to medium sized trees on strong land; (3) large trees, 5 to 6 feet, and heavily branched, do not make a uniform top growth when pruned back to a whip at planting time, since the strong, vigor-

ous buds on the younger wood are removed; (4) the best trees have developed from medium sized stock which were headed about two feet from the ground and all branches spurred to about 2 inches in length.

Tomatoes. An investigation was undertaken under greenhouse conditions to determine the influence, if any, of acid and alkaline condition of the soil upon tomatoes. The study is preliminary and incomplete, but it has shown (1) that tomatoes grown in a mixed soil of peat and sand showing acidity of 6.3 pH were neither benefited nor harmed by additions of lime, as far as growth or production was concerned; (2) that sulfate of ammonia, applied to young plants, gave as favorable production as nitrate of soda; (3) that earliness of production did not seem to be influenced by the use of acid phosphate or potassium sulfate in this experiment. Tomato fruits grown in soil deficient in phosphorous contained 94.73 percent moisture (water); those grown in soil deficient in potassium contained 93.93 percent moisture, and those grown in soil with complete fertilizer contained 94.03 percent moisture. These results indicate that the use of phosphorous or potassium does not materially affect the proportion of dry matter in the fruit.

Bluegrass Pasture Enemies. The results of a study of two insects which, for several years, had injured bluegrass pasturage in this region, were published as Bulletin 265. The insect most abundant and destructive is the bluegrass plant bug, *Miris dolobratus,* a puncturing species that attacks the maturing seeds in the panicles. The parts of pastures in which the insect hibernated most abundantly were spots least closely grazed. The insect proves to be very closely confined to bluegrass in this region both in its food and in its egg-laying. The second insect studied, the green bug *Toxoptera graminum,* had disappeared in 1926, probably a result of predatory insect enemies and fungus parasites.

Insecticide Tests. In the experiments leading to the control of the Mexican bean beetle, the liquid sprays gave slightly better control than the dusts. A spray made of calcium arsenate, ¾ pound, lime 1½ pound in 50 gallons of water, and a

dust made of calcium arsenate, 1 pound, and hydrated lime 9 pounds, gave slightly better protection than any of the other insecticides used.

In tests for the suppression of the cucumber beetle, sodium fluosilicate did not give as satisfactory results as other poisons, proving, in mixtures of one pound of the poison to three pounds of hydrated lime or land plaster, seriously injurious to the plants.

Metabolism in the Chicken. A comparison of calcium carbonate (limestone), calcium sulfate (gypsum), tricalcium phosphate, calcium lactate and calcium chlorid as calcium carriers for laying hens on a diet of wheat, corn and skim-milk showed that calcium carbonate was the most effective, judged by the number of eggs produced, the average weight of the egg contents, the average weight of the shell and the thriftiness of the fowls. The increased production of egg contents during the presence of calcium carbonate in the diet suggests the inference that calcium in that form is more favorable to metabolism in the chicken than in the other compounds tried.

Chickens raised to maturity entirely without grit, in comparison with a corresponding lot that received it, were equal in every way to those of the check lot, raised under usual conditions. The chickens raised without grit received calcium carbonate in the form of finely crushed egg-shells. The gizzards of the chickens that received no grit were heavier than those of the ones receiving it, which suggests increased activity and development.

Bacillary White Diarrhea. A comparison of the agglutination test and the intradermal test thru the use of pullorin for the detection of bacillary white diarrhea has been made in five flocks of hens with a total of 658 birds. Of this number, 147 birds, or 22.3 percent reacted to the agglutination test. Of the 147 birds reacting to the agglutination test, 70 or 47.6 percent reacted to pullorin. Of 21 birds giving positive reaction to the agglutination test and negative reaction to the intradermal test, *Bacterium pullorum* was recovered from 19 on post mortem. *Bacterium pullorum* was not recovered from any one

of 17 birds giving positive pullorin tests and negative agglutination tests. The intradermal antigen or pullorin used was a commercial product. On the basis of this work, the agglutination test was found to be a much more reliable method of detecting bacillary white diarrhea in mature fowls than the intradermal test employed in this study.

Supplements for the Laying Mash. Tests with condensed and granulated buttermilk as supplements for the laying mash indicate that a milk supplement is not essential for high egg yields. Whether or not the meat scrap in the mash should be reduced and some commercial form of milk used to supplement the ration depends largely upon the availability of these sources of protein and their relative prices. Altho one year's data are not sufficient for definite conclusions, it seems from varying amounts tested, that 2½ percent meat scrap in the laying mash is sufficient when a liberal supply of skim-milk is available.

Ventilation of Laying House. A comparison of the open front (baffler) type of ventilation with that of a pen equipped with ventilators based on the King system showed no apparent difference in health and vigor or egg production between the chickens of the two pens.

Metritis in Mares. In a comparative study of the encapsulated organisms isolated from cases of metritis in mares and encapsulated organisms from other sources, twenty-five strains of equine origin were studied and found to be identical in their morphological, cultural, biochemical and serological properties. Cultures of Friedlander's and granuloma bacilli have been found to vary markedly, little uniformity being demonstrable in these groups. Recent work has shown that Friedlander's bacilli are divisible into four types on the basis of serological tests. The cultures recovered from mares have been found to be identical with one of these types.

Disease of New Born Foals. During the foaling season of 1926, post-mortem examinations were made on twenty-two foals. Eleven of these, or 50 percent, were found to be infected with *Bacterium viscosum equi*. Up to this time only four cases

of this infection had been noted in the United States, these four cases having been reported from this laboratory.

Infectious Abortion of Cows and Mares. Seven hundred and fifty-nine samples of blood from 62 herds of cows were tested for infectious abortion. The bacterin treatment for this disease was administered to 785 head of cattle on 29 farms, and 55 head of cattle on seven farms received treatment in the form of a vaccine. The results obtained in the treatment of cattle for this disease are quite encouraging. Sixty-five samples of blood were tested for infectious abortion of mares. Fourteen aborted fetuses were examined, but B. abortivo-equinus, the organism causing large outbreaks of infectious abortion of mares, was not isolated from any of these specimens. A streptococcus was isolated from five fetuses. Bacterin, made from the B. abortivo-equinus, was administered to 1565 mares on 52 farms. Seventy samples of blood from swine were tested for infectious abortion and 335 head of swine were vaccinated against abortion with bacterin prepared at this laboratory. Investigations show a variation in agglutination tests for infectious abortion of cows when different strains of Bacterium abortus (Bang) are used as antigen. This phase of the problem is receiving further attention.

Hogging Down Corn with and without Supplements. The results of this year's tests indicate that it is profitable to supplement corn, whether the supplement is a protein, a mineral mixture, or both combined. The addition of salt was of some advantage, tho not marked. Tankage proved superior to all other forms of supplement. The males made a slightly better gain per head than the females, producing 44.16 pounds of pork per head, or an average daily gain of 1.53 pound as compared with 37.14 pounds of pork produced by the females with an average daily gain of 1.35 pound.

Range for Pork Production. Pigs farrowed and raised on new ground made faster growth, had less sickness and the sows raised a larger number of pigs per litter than those cared for on the old piggery grounds. When treated for worms, the usual large number of round worms were expelled from the

pigs raised on infested ground, while those raised on new grounds passed only very few worms.

Steer Feeding. The purpose of the test was to compare the daily rate of gain and economy of gains between two-year-old and yearling steers. Contrary to the general opinion, the yearling steers made a larger total gain and a larger daily gain than did the two-year-olds. Also, the yearlings made their gains at a lower cost per hundred pounds than did the older steers.

Feeding Breeding Ewes. During the breeding season and preceding the lambing period, the Station flock of breeding ewes was fed alfalfa hay in addition to the standard grain ration of equal parts by weight of oats and bran. In comparison with the preceding year, when all ewes were fed soybean hay, it was noted that they cleaned up the alfalfa hay more completely than they did the soybean hay and that the alfalfa hay was less constipating than soybean hay. For the eighth consecutive year there were no losses in the Station flock during pregnancy. This more firmly substantiates the statement made in last year's report that the freedom from loss may probably be attributed to the fact that the ration fed was properly balanced, contained sufficient protein and mineral matter for developing the unborn, and contained no constipating feeds.

Fattening Spring Lambs on Pasture. A third test was completed, comparing gains made on bluegrass pasture with the gains made on a mixture of rape and oats as a supplementary pasture for fattening spring lambs. The lambs on bluegrass pasture made an average gain of 7 pounds each in 28 days; the lambs on rape and oats pasture made an average of 10.2 pounds in 28 days.

Comparative Gains of Wether, Ram and Ewe Lambs. During the summers of 1924, 1925 and 1926, the lambs of the Station flock were placed on feeding trials for a period of 28 days each year. The grain fed and the pasture available were the same each year. The results show little difference in the gains of ewe and wether lambs. In fact, the wether lambs slightly outgained the ewe lambs in two of the three tests. The num-

ber of ram lambs was too small to warrant drawing any conclusions, tho the difference in their favor was quite striking. All lambs were docked.

Home Economics. Projects have been conducted to determine the vitamin content of kale and mustard greens, to study the variation in cooking quality of potatoes, and to investigate the metabolism of obesity.

Feed Control. The introduction of chemical standards in the control work of the department has meant a great deal to the feeders of the state by giving them higher grade feeds thru the elimination of a tremendous lot of highly fibrous and waste materials in so-called special purpose mixed feed. The complete information on feeds of every kind which it is possible to furnish to those concerned, under the present system of analysis, both chemical and microscopical, has placed the department in greater demand than ever before. The scope of the scientific feeding of all classes of animals is widening and is indicated by the great variety of feed samples sent to the laboratory by dairymen, farm bureaus, cooperative organizations, county agents and like agencies. Analyses have been made of 1,026 samples, 271 of which were sent in by consumers and dealers. Thirteen suits have been filed during the year for violations of the law, eight in federal courts and five in state courts. The feed consumption for the year is estimated at thirteen million dollars, representing a tonnage of over two hundred and fifty thousand.

Public Service Laboratories. This department has handled a total of 51,634 specimens this year, in its several laboratories, an average of nearly a thousand specimens a week. Of this number, 50,331 were examined in the bacteriological laboratory, 1,061 in the food laboratory and 242 in the drug laboratory. Specimen containers sent out numbered 30,789. The number of examinations for rabies this year is almost double that for 1925, with a corresponding increase in the number of positive findings.

Creamery and Tester's License. Seven hundred and forty-five licenses have been issued by this department, authorizing

their holders to buy milk or cream on the basis of the butterfat contained therein. These licenses are held by 34 creameries, milk plants and ice cream manufactories which have been in operation for one year or more, and 5 by such plants beginning operation this year; 6 by cooperative buying and shipping agencies; 30 by independent buyers; 546 by cream buying stations in operation June 30, and 124 by cream buying stations beginning operation since June 30.

Twenty-seven examinations for tester's license were held as follows: Louisville 7, Lexington 6, Bowling Green 5, Paducah 4, Owensboro 3, Cincinnati 2. Notices of these examinations were sent to 484 persons, 387 of whom appeared. Of those examined, 294, or 76 percent, made a passing grade. There are at present, 867 authorized testers in Kentucky, 561 of whom hold renewal license granted July 1, 1925, 155 are new operators licensed since that date, and 151 are operating on permits.

Four hundred and twelve inspections were made and based upon these inspections, the operators were graded as follows: A (excellent) 13; B (good) 127; C (unfavorable) 174; D (probationed) 87; E (revocation of license recommended) 11. The causes for the unfavorable grading of operators, those in C, D and E grades, were over-reading 56 percent; under-reading, 23 percent; disregard of rules and regulations, 10 percent; manipulation of the test, 7 percent; new operators violating provisions of the law, 2 percent; disorderly and insanitary, 2 percent.

Acting upon the above inspections, the Examining Board revoked the license of nine operators, one was carried over and one is awaiting action. Three station licenses were revoked for violations of the law and court proceedings have been instituted and are now pending in one case.

The glassware inspected number 22,173 pieces, only 36 of which were rejected as inaccurate.

The receipts for the year were $7,487.12 and the expenditures $5,562.82 distributed as follows:

Salaries	$3,083.34
Labor	735.50
Postage and Stationery	137.80
Freight and express	1.26
Sundry and Laboratory Supplies	164.99
Travel	1,425.93
Contingent	14.00
Total	$5,562.82

Robinson Substation. Seven acres of Reid's Yellow Dent and six acres of Johnson County White corn gave an average yield of 67 bushels per acre. One acre of Johnson County White, grown on exceptionally good river bottom land, gave a yield of 97 bushels.

Alfalfa, seeded in April, 1925, on a 2-acre plot, produced from one to one and one-half tons of hay per acre per cutting, and three cuttings were secured.

No difference in quality was observed between tobacco grown high on the hillside this year and that grown on the lowland last year, the fertilizer treatment being the same in both instances.

All the small fruits yielded well, about one hundred gallons of choice berries being secured from a one-eighth acre planting.

Thru the demonstrations and results at the Substation, much interest has been aroused in purebred seed and livestock among the farmers of this community. Assistance has been rendered them thru the exchange of purebred cockerels and seed corn, free service for good dairy cows, and the sale, at a nominal price, of purebred shotes.

The forestry work is showing satisfactory progress and much attention has been devoted to protection from fire. Many new trails have been opened and old ones cleared.

The first annual Robinson Harvest Festival was held at the Robinson Substation, Quicksand, September 23-24. Several thousand copies of the catalog were printed and distributed thruout eastern Kentucky. The interest manifested at this festival was remarkable and about one thousand persons were

in attendance. Competition was keen and the exhibits of farm products, poultry, stock, needlework and canning far exceeded the expectations of those in charge. The larger settlement and church schools thruout the mountain section cooperated and added much to the success of the festival by their fine displays.

Western Kentucky Substation. Work at the Western Kentucky Substation has included the initiation of a number of experimental projects, various general farm activities necessary in preparation for additional experiments, the construction of several farm buildings and other farm improvements.

Fifty-five acres of rough, rolling land on what is known as the Jacobs tract, were completely grubbed off, terraced, limed and fertilized and sown to rye this fall, on nine acres of which soil erosion experiments have been begun.

On the general crop areas of the substation farm, alfalfa and sweet clover have done well following applications of limestone and phosphate, and pasture mixtures of grasses and clovers have started off nicely. Sufficient corn and forage crops were grown on the farm to feed all the livestock and poultry for another year.

The first crop from the 1925 planting of raspberries was harvested this year and a favorable yield of good berries found a ready local market. Sixty-four small experimental plots of strawberries were started in the spring of 1926 for the purpose of studying the fertilizer requirements of strawberries and to determine the value of different soil improvement crops in the strawberry rotation. An initial planting of 320 peach trees and 120 apple trees was made on the Jacobs tract this fall, these occupying about eight of the forty acres reserved on this tract for experimental orchard work.

New Projects. The following is a list of the new projects undertaken this year:

Preparturition intoxication, toxemia of pregnancy or pregnancy disease of ewes.

A study of the social and economic effect occurring, as a result of the marked lowering of land values, to a group of

farm families who purchased farm lands at or near the peak prices.

A study of variations in the cooking qualities of potatoes.

Experiments on lime and fertilizer requirements of the soils of limestone origin at the Western Kentucky Substation.

A study of the effectiveness of different legumes in the maintenance of productiveness. Western Kentucky Substation.

Fertilizer and rotation experiments with tobacco. Western Kentucky Substation.

Pasture experiments. Western Kentucky Substation.

The effect of environmental factors on the physiological and morphological responses of legume forage crops.

Bacillary white diarrhea in hens and chicks, distribution, diagnosis and prevention.

Investigation of some truck crop insects.

Determination of the effect of differences in the chlorine content of fertilizers on the chlorine content and quality of burley tobacco.

Changes in Staff. The personnel of the Experiment Station is shown on page 2 of this report. The appointments and resignations for the year follow:

Appointments:

W. L. Rouse, assistant in farm management, February 8.

W. C. Eskew, inspector, creamery license section, September 1.

Resignations:

Thomas Baird, assistant in farm management, February 1.

J. W. Jones, assistant in markets, September 1.

Library. Eight hundred and fifty-seven volumes were received during the year, bringing the total accessions to 11,659. The number of periodicals subscribed for is slightly less than that of last year, the number being 119 domestic and 33 foreign.

Publications.

Bulletins

No.

264. Steer feeding. E. S. Good and L. J. Horlacher. January, 1926.
265. Two important enemies of bluegrass pastures. H. Garman. February, 1926.
266. The tobacco flea-beetle. H. H. Jewett. March, 1926.
267. Wintering steers with and without corn silage preparatory to finishing on grass without grain. E. S. Good. April, 1926.
268. Commercial feeding stuffs in Kentucky in 1925. J. D. Turner, H. D. Spears, W. G. Terrell and P. H. Senn. April, 1926.
269. A study of clover failure in Kentucky. E. N. Fergus and W. D. Valleau. April, 1926.
270. Kentucky livestock auction sales organizations. E. C. Johnson. April, 1926.
271. Cooperative marketing and price control. O. B. Jesness. October, 1926.
272. Field experiments on soils and crops. George Roberts, E. J. Kinney and J. F. Freeman. August, 1926.
273. Home-cured pork. E. J. Wilford. September, 1926.
274. Man labor, horse work and materials used in producing crops in Christian County. J. B. Hutson and W. G. Finn. June, 1926.
275. A study of the cost of producing tobacco in Kentucky. W. D. Nicholls. October, 1926.
276. Analyses of commercial fertilizers. H. E. Curtis, H. R. Allen and Lelah Gault. December, 1926.

Report:

Thirty-eighth annual report of the Experiment Station—1925. Thomas P. Cooper

Scientific Papers (in print):

Corn root-rot—a soil borne disease. W. D. Valleau, P. E. Karraker and E. M. Johnson. Journ. Agr. Research, Vol. 33, No. 5, pp. 453-476. Ill., 1926.

A method of growing corn seedlings (*Zea mays*) free from seed-borne organisms. W. D. Valleau and E. M. Johnson. Journ. Agr. Research, Vol. 32, No. 12, pp. 1195-1198. 1926.

The relation of nitrates to tobacco frenching. W. D. Valleau and E. M. Johnson. Science, Vol. 64, No. 1655, pp. 278-279. 1926.

Manganese and plant growth. J. S. McHargue, Indus. and Engineering Chemistry, Vol. 18, No. 2, p. 172. February, 1926.

Calcium and phosphorus content of strong and weak chicks from hens with and without calcium carbonate in their diet. G. Davis Buckner, J. Holmes Martin and A. M. Peter. The Am. Journ. of Physiology, Vol. 76, No. 1, pp. 28-34 March, 1926.

Concerning the growth of chickens raised without grit. G. Davis Buckner, J. Holmes Martin and A. M. Peter. Poultry Science, Vol. V, No. 5, pp. 203-208. June-July, 1926.

Further evidence that small quantities of copper, manganese and zinc are factors in the metabolism of animals. J. S. McHargue, The Am. Journ. of Physiology, Vol. LXXVII, No. 2, pp. 245-255. July, 1926.

The exudates from nutrient agar slants—the so-called water of condensation. Daniel J. Healy. Journ. of Bacteriology, Vol. XII, No. 3, pp. 179-180. September, 1926.

The influence of sulfur and gypsum on the solubility of potassium in soils and on the quantity of this element removed by certain plants. O. M. Shedd. Soil Science, Vol. XXII, No. 5, pp. 335-354. November, 1926.

The following have not yet been published, but have been accepted or are in an advanced state of preparation:

Mineral constituents of the cotton plant. J. S. McHargue. Read at the Convention of the Am. Chem. Soc., Tulsa,

Okla., April, 1926. The Journ. Am. Soc. of Agronomy, December, 1926.

The loss of nitrogen from chicken manure during drying. G. D. Buckner and A. M. Peter. Accepted by Poultry Science, July 6, 1926.

The significance of the occurrence of manganese, copper, zinc, nickel and cobalt in Kentucky bluegrass. J. S. McHargue. Read at the annual convention of the Am. Chem. Soc., Philadelphia, September, 1926. Will appear in Indus. and Eng. Chem.

Some egg-shell forming materials. G. Davis Buckner, J. Holmes Martin and A. M. Peter. To be submitted to the Am. Journ. of Physiology for publication.

Relation of calcium restriction to the hatchability of eggs. G. Davis Buckner, J. Holmes Martin and A. M. Peter. Prepared as a research bulletin of this Station.

Kentucky bluegrass—Whence did it come? J. S. McHargue. Read at the annual meeting of the Kentucky Acad. of Science. Will appear in the Transactions of the Academy, Vol. 2.

Intensive heating as an aid to a short digestion for the determination of nitrogen by the official method. O. M. Shedd. (In preparation.)

Soils of the Purchase Region of Kentucky. Manuscript prepared by S. D. Averitt and S. C. Jones for a Station bulletin.

FINANCIAL STATEMENT

In Account with the United States Appropriations, 1925-1926:

	Hatch Fund	Adams Fund	Purnell Fund
Receipts from the Treasurer of the United States, as per appropriations for fiscal year ended June 30, 1926, under acts of Congress approved March 2, 1887 (Hatch Fund), March 16, 1906 (Adams Fund), and February 24, 1925 (Purnell Fund)	$15,000.00	$15,000.00	$20,000.00
Expenditures by salaries	15,000.00	15,000.00	17,170.29
Labor			651.50
Stationery and office supplies			4.16
Scientific supplies, consumable			507.44
Feeding stuffs			3.58
Sundry supplies			87.90
Fertilizers			
Communication service			.90
Travel expense			923.28
Transportation of things			6.73
Publications			
Heat, light, water, and power			
Furniture, furnishings, fixtures			153.00
Library			37.85
Scientific equipment			444.37
Livestock			
Tools, machinery, and appliances			9.00
Buildings and land			
Contingent expenses			
Balance			
Total	$15,000.00	$15,000.00	$20,000.00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Kentucky Agricultural Experiment Station for the fiscal year ended June 30, 1926; that we have found the same well kept and classified as above; that the balance brought forward from the preceding year was none on the Hatch Fund and none on the Adams Fund; that the receipts

for the year from the Treasurer of the United States were $15,000.00 under the act of Congress of March 2, 1887, $15,000.00 under the act of Congress March 16, 1906, and $20,000.00 under the act of Congress of February 24, 1925, and the corresponding disbursements $15,000.00, $15,000.00, and $20,000.00; for all of which proper vouchers are on file and have been by us examined and found correct, leaving balances of none, none and none, respectively.

And we further certify that the expenditures have been solely for the purposes set forth in the acts of Congress approved March 2, 1887, March 16, 1906, and February 24, 1925, and in accordance with the terms of said acts, respectively.

Signed:

H. M. Froman
F. M. McKee
Auditors

Seal of
Institution.

Attest:
Teresa Buchignani
Custodian of the Seal.

METEOROLOGICAL SUMMARIES

For the Year 1926

Compiled from the Records of the U. S. Weather Bureau Station, Lexington, Ky.

ANNUAL METEOROLOGICAL SUMMARY

Month	Temperature, Degrees Fahrenheit							Relative Humidity Per cent 7 a. m.	Precipitation, in Inches				Per cent of Sunshine	Wind					Number of Days											
	Mean			Extreme										Average Hourly Velocity	Prevailing Direction	Maximum For 5 mins.			Gales, 40 miles per hour or over	Clear	Partly Cloudy	Cloudy	Precipitation of .01 inch or more	With trace or more of snow	Thunderstorms	Dense fog	Max. Temp.		Min. Temp.	
	Maximum	Minimum	Monthly	Maximum	Date	Minimum	Date		Total	Maximum in 24 hours	Date	Total Snowfall, Ins.				Velocity	Direction	Date								90 deg. or above	Freezing or below	Freezing or below	Zero or below
January	39.3	24.8	32.0	59	20	5	23	87	4.43	2.37	21-22	9.6	34	15.1	SW	54	W	27	2	9	4	18	15	8	0	3	0	10	22	0
February	45.2	29.4	37.3	61	21	10	11	86	2.27	0.57	13-14	2.3	28	13.4	SW	58	SW	25	1	4	10	14	14	11	3	0	0	5	19	0
March	45.4	28.0	36.7	72	24	11	13	82	2.52	1.00	22-23	4.6	36	16.1	SW	56	SW	31	4	7	9	15	18	13	0	0	0	7	19	0
April	58.4	39.1	48.8	78	30	26	4	74	1.54	0.43	27	T	43	13.5	SW	50	SW	27	2	10	9	11	11	1	0	0	0	0	6	0
May	75.2	54.0	64.6	89	25	34	4	69	2.06	0.96	31-J.1	0	62	12.1	SW	40	W	10	1	15	10	6	9	0	7	0	0	0	0	0
June	78.1	60.6	69.4	89	17	51	5	73	2.78	0.77	17	0	69	12.3	SW	57	NW	17	2	15	11	4	14	0	7	0	0	0	0	0
July	85.9	67.6	76.8	97	21	55	14	76	5.95	1.79	6	0	65	10.9	SW	52	NE	6	2	18	9	4	13	0	12	2	9	0	0	0
August	83.8	68.2	76.0	95	11	60	8	86	7.03	2.60	24-25	0	60	9.3	SW	44	SE	11	1	14	11	6	17	0	9	1	3	0	0	0
September	80.0	63.1	71.6	88	14	42	26	a88	4.04	1.78	25	0	57	11.1	SW	48	NE	2	1	12	12	6	9	0	4	2	0	0	0	0
October	65.0	49.3	57.2	85	1	32	25	86	7.46	1.91	12-13	T	51	12.1	SW	36	SW	28	0	11	12	8	16	1	6	2	0	0	2	0
November	48.6	33.0	40.8	70	14	16	22	82	3.21	0.87	15-16	2.8	41	15.7	SW	52	SW	26	2	10	7	13	10	5	0	0	0	4	16	0
December	42.0	27.9	35.0	66	13	10	16	88	4.32	1.31	20-21	0.2	24	13.7	SW	38	NW	5	0	3	9	19	12	7	0	5	0	6	19	0
The Year	62.2	45.4	53.8	97	July 21	5	Jan. 23	81	47.81	2.60	Aug. 24-25	19.5	48	12.9	SW	58	SW	Feb. 25	18	128	113	124	158	46	48	15	12	32	103	0

a 1 observation missing.

MONTHLY AND ANNUAL MEAN TEMPERATURE

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann.
1872											37	27	
1873	30	35	42	53	66	74	75	74	67	53	40	39	54.0
1874	36	38	44	46	66	77	78	75	71	57	45	38	56.0
1875	27	29	42	49	64	72	76	71	64	52	43	43	52.7
1876	41	39	41	52	65	72	77						
1887											44	35	
1888	31	36	41	56	63	72	76	74	63	51	46	37	54.0
1889	37	32	46	55	63	69	75	72	65	52	43	50	55.0
1890	44	45	39	56	63	77	76	71	67	56	49	37	56.6
1891	37	41	40	57	62	76	73	73	72	55	43	43	56.0
1892	28	41	39	54	63	76	75	75	68	57	41	33	54.1
1893	23	36	43	57	61	72	79	74	70	57	43	37	54.4
1894	38	34	49	54	62	75	76	76	71	58	41	37	55.9
1895	28	25	43	56	62	75	73	76	72	52	45	37	53.7
1896	34	35	38	62	71	72	75	75	67	54	48	38	55.9
1897	30	37	48	53	59	72	76	74	72	64	46	37	55.7
1898	38	36	49	50	65	74	76	76	72	56	43	33	55.8
1899	34	24	42	56	67	75	77	77	68	61	48	33	55.1
1900	36	31	39	55	66	72	77	79	73	65	45	37	56.3
1901	34	29	44	49	63	74	80	74	67	58	40	31	53.6
1902	32	25	45	53	68	71	77	74	67	59	53	34	54.8
1903	32	36	50	53	68	68	77	74	70	57	40	28	54.4
1904	30	31	46	48	64	72	74	74	69	57	44	34	53.5
1905	24	25	49	54	66	72	75	74	68	55	44	35	53.5
1906	37	32	36	57	64	72	74	76	71	55	45	36	54.5
1907	40	32	52	45	59	69	76	73	68	53	42	37	53.8
1908	33	33	50	55	65	72	76	75	72	58	48	38	56.1
1909	37	41	43	54	62	73	73	74	66	53	53	28	54.6
1910	32	31	54	54	59	69	75	73	70	60	40	29	53.7
1911	38	40	43	52	70	74	76	76	72	58	40	41	56.6
1912	23	28	39	57	65	69	75	72	70	59	44	36	53.1
1913	42	35	44	53	65	73	78	77	69	56	49	38	56.5
1914	37	29	40	54	66	75	78	75	67	59	46	30	54.6
1915	32	40	36	59	62	70	74	70	70	60	49	36	54.8
1916	40	33	41	52	67	69	78	76	67	58	47	34	55.2
1917	25	32	44	54	57	70	74	74	67	50	44	25	52.3
1918	20	38	49	52	69	72	73	79	62	61	44	43	55.2
1919	37	36	46	54	62	76	79	74	72	64	45	31	56.3
1920	30	33	45	50	62	71	74	72	70	62	43	36	54.1
1921	37	38	55	58	65	76	80	75	73	57	48	39	58.4
1922	33	33	47	57	68	75	76	75	73	61	47	39	57.3
1923	39	32	43	53	63	74	77	74	69	56	45	45	55.8
1924	30	33	39	55	58	73	73	75	64	62	45	34	53.5
1925	53	43	47	59	66	76	75	76	76	50	43	32	55.8
1926	32	37	37	49	65	69	77	76	72	57	41	35	53.8

TEMPERATURE EXTREMES

Month	Highest	Year	Day	Lowest	Year	Day
January	72	1906	21	—14	1918	12
February	75	1918	28	—20	1899	13
March	85	1910	24	— 1	1873	4
April	99	1925	24	15	1875	18
May	93	1911	28	30	1876	1
June	99	1914	27	40	1910	3
July	102	1901	22	51	1851	9
August	100	1918	6	46	1915	31
September	99	1925	9	32	1899	30
October	89	1919	2	21	1925	29
November	78	1895	7	2	1872	29
December	71	1875	31	— 9	1917	10

MONTHLY AND ANNUAL PRECIPITATION

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann.
1872											1.21	3.39	
1873	2.53	4.05	3.73	2.89	6.05	4.49	3.37	2.94	1.60	5.47	1.92	4.48	43.52
1874	5.41	4.89	5.90	6.81	0.79	3.55	6.26	1.57	2.89	0.92	4.27	3.83	47.09
1875	2.61	3.12	6.18	2.06	2.43	4.16	11.24	0.62	1.72	2.37	5.87	3.68	46.06
1876	6.06	1.66	3.63	4.20	2.16	4.13	3.84						
1887											3.02	2.71	
1888	4.39	2.93	5.82	3.17	3.29	2.97	4.21	8.76	1.22	3.02	5.15	1.88	46.81
1889	5.66	1.78	1.63	1.52	3.53	3.49	5.82	1.15	6.79	3.06	5.34	1.73	41.50
1890	5.34	8.13	9.91	3.59	4.71	7.43	3.14	7.32	1.82	2.38	3.54	4.05	61.36
1891	4.70	4.36	7.63	1.85	1.17	5.33	3.23	6.48	1.26	1.33	5.38	2.82	45.51
1892	2.35	3.10	4.01	6.57	5.32	3.81	6.22	3.28	4.10	0.45	3.72	3.03	45.96
1893	2.10	4.44	3.30	5.81	3.88	4.24	3.11	1.86	2.25	5.59	3.36	2.61	42.55
1894	3.88	3.33	2.13	4.19	3.81	4.44	0.87	3.67	4.05	1.40	1.38	3.45	36.32
1895	5.60	0.52	2.79	3.17	4.05	2.93	5.07	1.56	0.33	1.28	2.52	5.50	35.32
1896	1.25	3.15	5.41	0.40	3.20	3.74	10.39	3.37	4.25	1.27	4.30	2.56	43.29
1897	2.59	6.33	6.55	5.80	4.48	4.77	4.34	3.21	0.86	0.38	4.83	5.11	49.19
1898	9.56	2.20	8.18	3.29	6.13	7.94	5.72	2.99	3.55	5.27	2.89	2.80	60.52
1899	6.69	2.84	8.61	2.16	3.63	2.55	0.97	4.18	1.90	2.09	1.70	2.92	40.24
1900	2.13	3.17	1.98	1.23	3.54	2.19	2.80	5.75	1.85	0.79	6.38	1.86	33.67
1901	1.49	0.62	2.23	4.52	2.67	3.70	2.61	3.74	2.18	1.33	1.73	3.50	30.32
1902	4.77	0.90	2.92	1.27	2.43	5.19	2.33	1.89	2.60	2.11	3.09	6.60	36.10
1903	1.68	6.16	3.24	3.29	1.75	2.71	2.62	1.49	0.81	2.12	2.84	1.99	30.70
1904	1.92	2.38	4.75	3.08	2.60	2.51	3.13	2.44	1.71	0.57	0.53	3.10	28.72
1905	2.04	2.13	5.87	2.87	5.54	3.31	4.94	4.11	3.20	3.45	3.58	4.13	45.17
1906	2.29	1.84	6.45	1.11	3.15	4.68	3.89	4.92	5.03	0.74	3.95	4.54	42.59
1907	9.96	1.89	4.13	1.83	3.89	3.65	4.42	2.07	2.72	2.76	2.67	2.28	41.37
1908	1.85	4.81	8.17	4.99	4.20	2.12	3.60	2.98	0.38	0.72	1.65	2.13	37.60
1909	3.55	6.86	3.97	6.72	4.15	5.41	5.98	1.26	4.88	2.05	1.96	2.77	49.36
1910	4.46	4.11	0.46	4.22	6.24	5.92	7.66	4.15	7.92	1.67	1.72	2.81	51.34
1911	2.44	2.21	2.31	4.46	1.07	3.01	0.92	2.84	4.37	3.67	3.84	6.20	37.34
1912	1.78	2.50	4.36	6.89	5.11	2.15	4.70	3.23	2.09	0.51	1.02	3.66	38.00
1913	10.35	2.61	6.04	2.41	4.32	3.28	2.43	1.00	1.76	3.40	4.00	2.74	44.35
1914	2.50	3.87	2.24	2.23	1.65	4.77	2.63	4.69	1.82	5.32	1.62	4.40	37.74
1915	4.38	1.12	1.49	0.65	7.23	3.20	5.72	6.02	3.74	0.81	3.90	6.67	44.94
1916	5.65	3.40	3.30	1.01	2.92	5.33	1.72	2.24	2.75	2.04	1.25	3.63	35.34
1917	5.67	2.12	5.48	3.97	3.51	3.54	2.80	1.94	2.46	2.36	1.03	1.97	36.85
1918	4.46	1.92	1.55	2.09	4.13	3.61	2.01	2.68	1.41	4.57	2.24	4.83	35.50
1919	2.48	1.61	3.71	3.51	6.38	4.49	2.28	2.39	1.12	7.95	8.50	6.70	51.12
1920	5.26	2.11	4.62	6.42	2.51	2.39	1.73	6.71	4.88	2.75	2.22	1.40	43.00
1921	3.24	2.62	5.06	3.28	1.60	2.16	1.04	3.88	5.10	2.46	6.89	5.74	43.07
1922	1.87	3.12	7.75	4.46	3.10	2.44	2.13	2.20	5.99	1.25	0.88	5.67	40.86
1923	6.63	4.40	4.65	5.43	1.66	3.55	5.01	4.02	1.51	0.56	2.71	6.50	46.63
1924	5.00	2.60	2.42	3.75	3.04	4.04	2.77	2.28	3.89	0.11	1.32	5.95	36.81
1925	3.41	3.03	3.45	2.49	3.56	3.96	3.63	1.15	1.70	5.83	4.52	0.80	37.52
1926	4.43	2.27	2.52	1.54	2.06	2.78	5.95	7.03	4.04	7.46	3.21	4.32	47.61

EXTREMES OF PRECIPITATION AND WIND

Month	PRECIPITATION			WIND			
	Greatest in 24 hrs.	Year	Day	Max. Vel.	Dir.	Year	Day
January	3.50	1913	11	60	sw	1891*	1
February	3.04	1909	23-24	60	sw	1890*	25
March	3.61	1913	25-26	68	sw	1919	17
April	3.24	1909	29-30	64	sw	1909	29
May	2.61	1898	6-7	60	nw	1889*	12
June	4.45	1898	26-27	60	n	1890*	29
July	4.02	1875	11-12	58	nw	1915	30
August	2.98	1915	1-2	72	s	1918	6
September	5.45	1922	3	68	w	1889	8
October	2.78	1925	16-17	50	nw	1904*	21
November	3.95	1919	25-26	62	s	1895*	26
December	3.63	1919	6	60	sw	1895*	26

*Also in subsequent years.